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H. D. Hughes
Iowa State College

L. J. Thorp
Iowa State College

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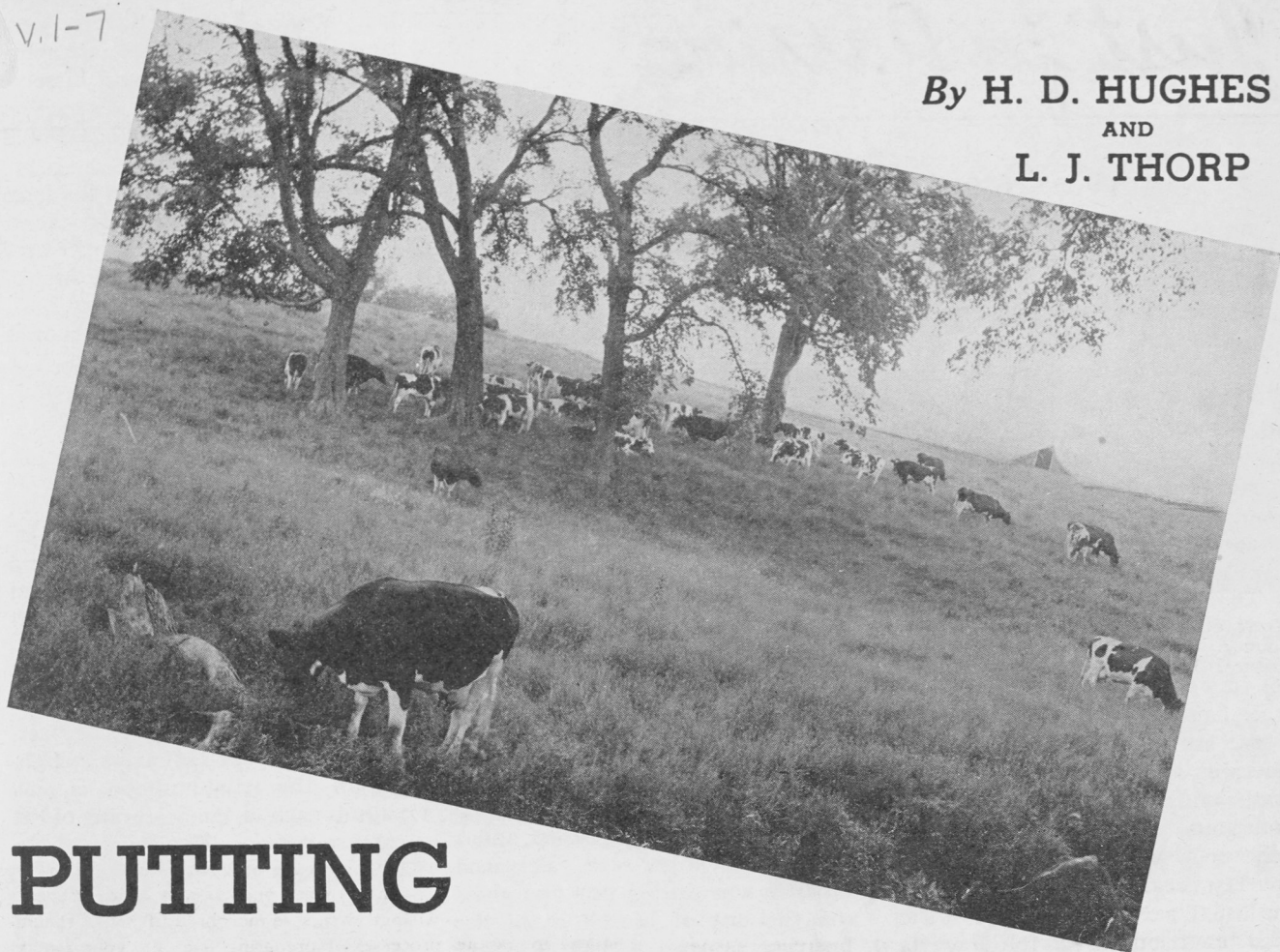
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By H. D. HUGHES
AND
L. J. THORP



PUTTING *New Life* INTO PASTURES

*Reseeding, Lime, Phosphate Fertilizer at
Mt. Pleasant Brought Nearly Double Yields*

MANY OF THE old permanent bluegrass pastures in Iowa can almost be made "to feed two cattle where one fed before." We found this out from a study of the problem at Mt. Pleasant during the 6 years, 1933 to 1938. In the past 3 years some 250 Iowa farmers in 45 counties have cooperated in demonstrating the possibilities of increasing the returns from permanent pastures by introducing clover into old grass sods and from applying lime and phosphate fertilizer in addition to reseeding.

When we reseeded and manured the land at Mt. Pleasant, the number of "animal-pasture-days per acre" increased from 97.8 to 174.9. That is, 1 acre of the untreated bluegrass pasture fed one steer or

cow for 97.8 days, but an acre which was limed, reseeded (reseeded with sweet clover, alsike and red clover) and with phosphorus and potash fertilizers added fed one steer for 174.9 days. These were the averages for the 6-year period.

On the plot which was limed and reseeded, the animal-pasture-days increased from 97.8 to 133.1; on the plot which was manured and reseeded (with the three clovers), the animal-pasture-days increased from 97.8 to 174.9; liming, reseeded, adding phosphorus, potash and nitrogen fertilizers increased the animal-pasture-days to 151.7 days. The nitrogen fertilizer along with the other treatments did not pay, for it increased the cost and decreased the returns.

Our study at Mt. Pleasant was made in cooperation with the State Board of Control which furnished the land, the cattle for grazing, the lime, fertilizer, fencing and such other materials as were needed.

Mt. Pleasant Studies

The State Hospital farm at Mt. Pleasant, which is one of the 16 farms under the State Board of Control, turned over to us for the pasture improvement studies approximately 34 acres which had been in permanent pasture for many years. Part of this had once been in cultivation, but erosion and gullying had long ago made cropping impossible. The grass consisted mostly of Kentucky blue-



Steers at the end of the season on the improved pasture at Mt. Pleasant in Henry County. A heavy growth of sweet clover had been consumed on this limed-reseeded pasture. It provided 133 animal pasture days per acre as compared with only 97 days on the untreated bluegrass.

grass, but there was also a considerable amount of Canada bluegrass and redtop. Weeds were numerous, especially the whorled milkweed, white top, horse mint, poverty grass and Indian tobacco, the last two constituting almost the entire cover on the less fertile areas, and especially on knobs and steep slopes where the surface soil was entirely gone. The soil and surface were typical of much pasture land in southern Iowa. The coverage and productivity of the grass were exceedingly variable; thick and vigorous on the bottoms and in draws, but on the upland, which constituted most of the area, the sod was thin and weak.

Six pastures of approximately 5.7 acres each were laid out, with shade and water in each, and with soil conditions as to topography and productivity within each pasture equal as far as we could determine. The treatments of the different pastures were as follows:

- No. 1 Reseeded only.
- No. 2 Manured and reseeded.
- No. 3 No treatment (standard for comparison).
- No. 4 Limed and reseeded.
- No. 5 Limed, reseeded, phosphorus and potash fertilization.
- No. 6 Limed, reseeded, phosphorus, potash and nitrogen fertilization.

Reseeding. The reseeded mixture used and the rate of seeding was 5 pounds of biennial white sweet clover, 3 of red clover and 2 of alsike clover per acre. This seed mixture was drilled into the grass sod the last of March or in the first days of April of 1933, 1935 and 1937. The drilling was done while the surface soil was wet and spongy, the discs of the drill being forced into the ground 2 to 3 inches.

Manure Top-Dressing. About 10 tons per acre of manure were applied evenly over the surface of pasture No. 2 in the winters of 1932-33, 1934-35 and 1936-37.

Lime. Lime at the rate of 3 tons per acre was broadcast over the surface of pastures 4, 5 and 6 late in April, 1933, at the same time that the first seedings were made. Tests of soil samples from different parts of the area indicated that 3 tons were sufficient to correct the acidity of the surface plow slice over most of the area—more than sufficient in some places and hardly enough in others.

Phosphorous and potash. Phosphorus and potash were applied to pastures 5 and 6 at the same time that the reseeded was done. Phosphorus in the form of 20-percent superphosphate was applied at the rate of 125 pounds per acre, and potash in the form of muriate of potash at the rate of 100 pounds

per acre. The fertilizers were broadcast on the surface, assuming that the first rains would dissolve and carry them into the disc gashes where the clover seedlings would be coming on.

Nitrogen. Nitrogen in the form of ammonium sulfate was broadcast at the rate of 100 pounds per acre to pasture No. 6 about the first of April each spring, 1933 to 1937, inclusive. No application was made in the spring of 1938.

Measuring Results

We measured the relative productivity of the different pastures in animal-pasture-days, pounds in gain of animals and actual weight and composition of the herbage produced. For comparison in this discussion the animal-pasture-days record seems to be most useful.

The plan was to graze the pastures with 1-year-old steers, weighing in the neighborhood of 600 pounds each at the beginning of the pasture season. For a part of the 1933 season milk cows were used and in 1937 2-year-old dairy heifers. For the 1936 season 2-year-old steers, weighing in the neighborhood of 1,000 pounds, were used. An effort was made at the beginning of each pasture period to estimate the probable carrying capacity of the different pastures for the entire season when the animals got no supplementary feeding. When we found later that certain pastures were being grazed more closely or less closely than others, to even up the grazing, a sufficient number of animals was transferred from one pasture to another, after three daily weighings.

The animals usually were not placed on the pastures until after the middle of May when the grass varied in height from 4 to 8 inches, or more, because we expected the pastures to carry the animals through the dry summer period; also, it seemed desirable to allow the clover seedlings to make considerable growth before grazing was begun. We do not recommend this grazing management practice for general use.

In the accompanying table the animal-pasture-days per acre is shown for pastures 2 to 6, inclusive,

and for each of the 6 years, 1933 to 1938. In the first year of grazing we found that pasture No. 1, reseeded only, was not comparable with the other pastures. The grazing of this pasture was therefore discontinued so far as this study was concerned, and no results are included.

As an average for the 6-year period equally good production records were obtained from the manure-reseeded pasture (No. 2) and from the limed-reseeded-phosphated pasture (No. 5). Each had an average of 174.9 animal-pasture-days or 78.8 percent more than the untreated pasture (No. 3). The increased production on pasture No. 2 was due in the main to the manure top-dressing and not to the growth of clovers. Except on relatively small portions of this pasture where manure was not applied, there was very little clover. The vigorous, rapid growing, thick-sodded grass provided too much competition to allow the small clover seedlings to get established. At no time during the 6 years was there any significant amount of sweet clover on any part of the manured pasture. The soil evidently was too acid. This pasture had not been limed at any time.

Few farms produce anything like as much manure as could be used advantageously on the cropland. Since it appears that as good or better results can be obtained in pasture improvement by liming and getting clovers established in the grass sod, we believe that generally the manure could better be used elsewhere than on permanent pastures.

There is one exception to this general rule, however. In almost any permanent pasture there are points, slopes and knobs where the surface soil has been almost wholly lost by erosion and where the cover consists perhaps wholly of such weeds as poverty grass and Indian tobacco and where it is almost impossible to get clovers or grasses to grow. A top-dressing of stable manure applied on such areas during the fall or early winter will almost insure the success of seedings of grass or clover made the following spring. The manure gives the needed available fertility, mulches the surface and prevents rapid dry-

ing and discourages too close grazing of the new growth.

Phosphorous Big Help

In the sixth year of the test at Mt. Pleasant the limed, reseeded and phosphated pasture (No. 5) made an outstandingly better production than any of the other pastures, including the manured pasture (No. 2). In the first 2 or 3 years the manured pasture surpassed No. 5 rather consistently; in the fourth year there was very little difference; in the fifth year No. 5 was superior, and in the sixth, outstandingly superior.

The lime and phosphorus on plot 5 so stimulated the growth of the sweet clover that we feared even the bluegrass might be weakened and smothered. The considerable amount of nitrogen evidently added to the soil by the sweet clover, however, greatly stimulated the growth of the grass so that at the end of the 6-year period there was an ideal combination. Sweet clover seems to have a decided advantage over any other clover for the improvement of pastures, because when once established it will reseed itself and volunteer in the bluegrass from year to year.

In pasture No. 4 which was limed but not phosphated, red clover and alsike clover predominated over a considerable part of the pasture, and the growth of sweet clover was not particularly vigorous.

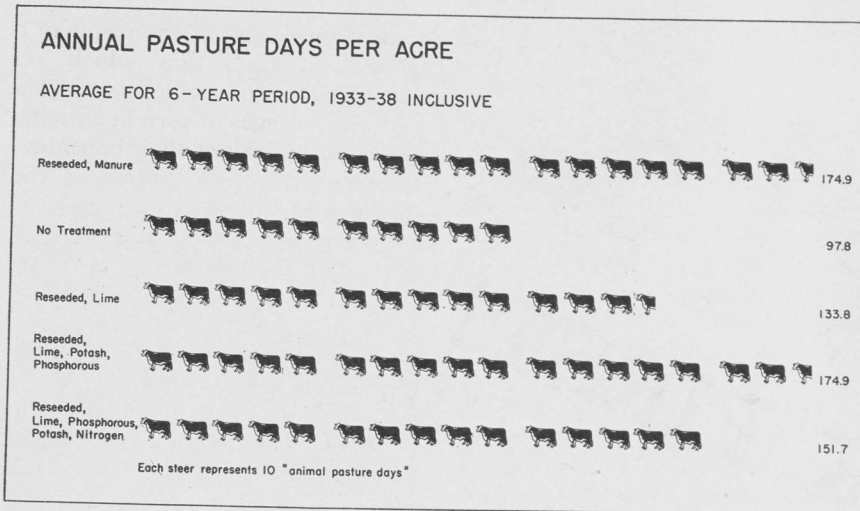
Perhaps the most striking result on any of our pasture treatments at Mt. Pleasant was the greatly increased vigor and yield that apparently resulted from the phosphorus on the clovers, and especially on sweet clover. Pastures No. 4 and No. 5, which were side by side, were handled exactly alike except that 5 had an application of 125 pounds per acre of 20-percent superphosphate and 100 pounds of muriate of potash. The phosphate added about 40 animal-pasture-days as an average for the 6 years. We believe the increased growth of clover on No. 5 resulted from the phosphate application rather than from the potash, because on plots at Mt. Pleasant where the potash was omitted the growth of clovers was fully equal to that where both fertilizers were applied.

The results were relatively uniform in the different years. Pasture No. 4, which was limed and reseeded only, gave the smallest increase over the untreated pasture in each year, except the first, when the results were not considered significant.

Pasture No. 6 which in addition to lime, reseeded and mineral fertilizers (phosphorus and potash) received each spring until 1938 100 pounds of ammonium sulfate (at a cost of \$2 an acre) produced less each year than the plot that received no nitrogen. It apparently is not profitable to apply nitrogen

This picture, taken May 25, 1936, was of Pasture 5, which was limed, received 125 pounds of superphosphate per acre and reseeded with 5 pounds of sweet clover, 3 pounds red clover, 2 pounds alsike per acre. Clovers at the time of this picture almost entirely hid the grass, but later the bluegrass grew more vigorously than before.





fertilizer in Iowa for pasture improvement.

Is Liming Justified?

Sweet clover is the best soil improving legume for the Corn Belt, but it will thrive only on soils well-supplied with calcium. Most of Iowa's unproductive pasture soils are acid, so sweet clover cannot be used in any improvement effort without applying lime.

The pastures and portions of pastures at Mt. Pleasant that were not limed had no sweet clover. There were considerable areas on some of the limed plots with a good stand of red and alsike clover but no sweet clover. These areas had not received enough lime to correct the high acid content of the soil.

It is important that sweet clover be included in any pasture improvement seeding, not only because of its value for pasture and as a soil builder, but also because this is the only clover adapted to the Corn Belt which can be expected to reseed, maintaining itself from year to year in a bluegrass pasture by volunteering from shattered seeds.

When a pasture is to be limed and reseeded the lime should be applied well in advance of the actual time of seeding. In 1933 and 1934 there was no sweet clover in the Mt. Pleasant pastures even though seed of this clover made up half of the quantity sown. This was because we could not get the lime on in advance of the seeding but had to apply it at the same time.

The increases in the yield of pasturage in these years were evidently due entirely to the red and

alsike clover. Both of these clovers are considerably more tolerant of acid soil than sweet clover, but they grow much more vigorously and make larger yields on limed soils or on soils that are naturally sweet.

Seedbed; Seed Early

When the stand of grass is thin and the growth weak, splendid stands of clover have been obtained by drilling early while the ground is loose, forcing the discs into the ground from 2 to 3 inches. But at Mt. Pleasant, on those parts with a good strong grass sod, little or no clover stand resulted; the grass apparently smothered the new seedlings.

Under average conditions we believe that discing the grass sod thoroughly in the very early spring, or late the preceding fall will be necessary. If lime is applied in the fall, we suggest that the discing be done afterward but before winter sets in. The seed can then be broadcast in late March and the

phosphorus applied at the same time, these operations to be followed by harrowing or, if the surface is dry enough to permit it, by firming with a cultipacker or roller.

From many seedings observed, we have concluded that if it is not possible to seed very early in the spring while there is plenty of moisture in the soil and it is loose from the freezing and heaving of winter, the expense of seed and seeding had better be saved by not seeding.

If the discing is done in the late fall, there is no reason why the seeding cannot be done early in the spring, almost regardless of soil or weather conditions.

The clover mixture used on the pastures at Mt. Pleasant, and more generally than any other over the state, is 5 pounds of biennial white sweet clover, 3 of red clover and 2 of alsike clover per acre. We recommend this mixture for limed soils and especially those which may be somewhat low in fertility. On soils which have not been limed and are likely to be acid, omit the sweet clover, increase the red clover to 5 pounds and the alsike to 3.

In 2 of the 6 years at Mt. Pleasant heat and drouth in midsummer made it necessary to take the animals off the permanent pastures entirely, and in other years animals lost weight for several weeks in midsummer. Sudan grass has outstanding value for summer pasture. A planting of this grass made in the latter part of May will provide a large amount of palatable, succulent, nutritious pasture for 6 weeks in midsummer just when Kentucky bluegrass is at its worst.

NUMBER OF ANIMAL-PASTURE-DAYS PER ACRE, YEARLY, 1933 TO 1938, INCLUSIVE, AND PERCENT OF THE AVERAGE OF THE UNTREATED PASTURE.

Plot No.*	Year						Six-year average	Percent of check
	1933	1934	1935	1936	1937	1938		
2	99.8	152.6	332.3	88.4	212.7	163.6	174.9	178.8
3 (Untreated)	49.6	75.9	172.4	53.6	112.6	122.9	97.8	—
4	88.7	120.6	219.6	70.4	140.3	159.2	133.1	136.1
5	80.0	141.1	308.0	85.6	218.1	216.4	174.9	178.8
6	76.5	124.4	256.9	77.5	196.4	178.2	151.7	155.1

*Treatments of the various plots were: No. 2—manured and reseeded; No. 3—no treatment; No. 4—limed and reseeded; No. 5—limed, reseeded, phosphorus and potash; No. 6—limed, reseeded, phosphorus, potash and nitrogen.